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CLAIMS

1. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, comprising:

a macro block forming step for forming a macro block from said plural blocks,

a signal format conversion step for converting said image data in said predetermined signal format into image data in another signal format,

an orthogonal transform step for orthogonally transforming said image data subjected to said signal format conversion, and

a coding step for coding the output of said orthogonal transform step, wherein

said signal format conversion step, said orthogonal transform step and said coding step are carried out continuously in said macro block units.

2. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, comprising:

a macro block forming means for forming a macro block from said plural blocks,

a signal format conversion means for converting said

image data in said predetermined signal format into image data in another signal format,

an orthogonal transform means for orthogonally transforming said image data subjected to said signal format conversion, and

a coding means for coding the output of said orthogonal transform means, wherein

said signal format conversion means, said orthogonal transform means and said coding means are carried out continuously in said macro block units.

3. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, wherein

a macro block is formed from said plural blocks,

said image data in said predetermined signal format is converted into image data in another signal format,

said image data subjected to said signal format conversion is orthogonally transformed,

the output of said orthogonal transform is coded, and

said signal format conversion, orthogonal transform and coding are carried out continuously in said macro block units.

4. A coding method in accordance with claim 1, wherein

said input image data comprises red, green and blue signals, and image data obtained after said signal format conversion comprises luminance, first color difference and second color difference signals.

5. A coding apparatus in accordance with claim 2, wherein said input image data comprises red, green and blue signals, and image data obtained after said signal format conversion comprises luminance, first color difference and second color difference signals.

6. A recording medium in accordance with claim 3, wherein said input image data comprises red, green and blue signals, and image data obtained after said signal format conversion comprises luminance, first color difference and second color difference signals.

7. A coding method in accordance with claim 1, wherein said input image data comprises luminance, first color difference and second color difference signals, and image data obtained after said signal format conversion comprises luminance, first color difference and second color difference signals having a configuration different from that before said conversion.

8. A coding apparatus in accordance with claim 2, wherein said input image data comprises luminance, first color difference and second color difference signals, and image data obtained after said signal format conversion

comprises luminance, first color difference and second color difference signals having a configuration different from that before said conversion.

9. A recording medium in accordance with claim 3, wherein said input image data comprises luminance, first color difference and second color difference signals, and image data obtained after said signal format conversion comprises luminance, first color difference and second color difference signals having a configuration different from that before said conversion.

10. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, comprising:

a pixel value detection step for detecting input pixel values in said block and for judging whether all the pixel values in said block are identical or nearly identical or not, and

an orthogonal transforming step, wherein, in a block judged by said pixel value detection step that all the pixel values are identical or nearly identical, DC coefficient component values are generated from the value of one pixel in said block, and all AC coefficient component values are set to zero, and in other blocks, ordinary orthogonal transform computation is carried out.

11. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, comprising:

a pixel value detection means for detecting input pixel values in said block and for judging whether all the pixel values in said block are identical or nearly identical or not, and

an orthogonal transforming means, wherein, in a block judged by said pixel value detection means that all the pixel values are identical or nearly identical, DC coefficient component values are generated from the value of one pixel in said block, and all AC coefficient component values are set to zero, and in other blocks, ordinary orthogonal transform computation is carried out.

12. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units, wherein

input pixel values in said block are detected, and a judgment is made as to whether all the pixel values in said block are identical or nearly identical or not, and

in accordance with the result of said judgment, in a block judged by said pixel value detection means that all

the pixel values are identical or nearly identical, DC coefficient component values are generated from the value of one pixel in said block, and all AC coefficient component values are set to zero, and in other blocks, ordinary orthogonal transform computation is carried out.

13. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction,

said method comprising:

a first orthogonal transform step for orthogonally transforming said input pixel values in said two-dimensional block in m pixel units in said first direction,

a pixel value detection step for detecting coefficient component values obtained at said first orthogonal transform step in n coefficient units in said second direction, and

a second orthogonal transforming step, wherein, in coefficients, detected by said pixel value detection step,

comprising said n coefficients in said second direction and having identical or nearly identical coefficient values, DC coefficient component values are generated from the value of one coefficient in said n coefficients, and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

14. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction,

said apparatus comprising:

a first orthogonal transform means for orthogonally transforming said input pixel values in said two-dimensional block in m pixel units in said first direction,

a pixel value detection means for detecting coefficient component values obtained at said first orthogonal transform means in n coefficient units in said second direction, and

a second orthogonal transforming means, wherein, in coefficients, detected by said pixel value detection means, comprising said n coefficients in said second direction and having identical or nearly identical coefficient values, DC coefficient component values are generated from the value of one coefficient in said n coefficients, and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

15. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction, wherein

said input pixel values in said two-dimensional block are orthogonally transformed in m pixel units in said first direction,

coefficient component values obtained by said orthogonal transform are detected in n coefficient units

in said second direction, and

in coefficients comprising said n coefficients in said second direction and having identical or nearly identical coefficient values, DC coefficient component values are generated from the value of one coefficient in said n coefficients, and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

16. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction,

said method comprising:

a first orthogonal transform step for orthogonally transforming said input pixel values in said two-dimensional block in m pixel units in said first direction,

a pixel value detection step for detecting coefficient component values obtained at said first orthogonal transform step in n coefficient units in said second

direction, and

a second orthogonal transforming step, wherein, in coefficients, detected by said pixel value detection step, comprising said n coefficients in said second direction and having coefficient values, all of which are 0 or nearly 0, DC coefficient component values for said n coefficients and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

17. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction,

said apparatus comprising:

a first orthogonal transform means for orthogonally transforming said input pixel values in said two-dimensional block in m pixel units in said first direction,

a pixel value detection means for detecting coefficient component values obtained at said first orthogonal

transform means in n coefficient units in said second direction, and

a second orthogonal transforming means, wherein, in coefficients, detected by said pixel value detection means, comprising said n coefficients in said second direction and having coefficient values, all of which are 0 or nearly 0, DC coefficient component values for said n coefficients and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

18. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

assuming that either the horizontal direction or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n pixels comprising m pixels in said first direction and n pixels in said second direction, wherein

said input pixel values in said two-dimensional block are orthogonally transformed in m pixel units in said first direction,

coefficient component values obtained by said

orthogonal transform are detected in n coefficient units in said second direction, and

in coefficients comprising said n coefficients in said second direction and having coefficient values, all of which are 0 or nearly 0, DC coefficient component values for said n coefficients and all AC coefficient component values are set to zero, and in others of said n coefficients, ordinary orthogonal transform computation is carried out.

19. A coding method in accordance with claim 10, 13 or 16, wherein said pixel value detection is carried out in k pixel units when using a computation apparatus capable of simultaneous computation in k pixel units.

20. A coding apparatus in accordance with claim 11, 14 or 17, wherein said pixel value detection is carried out in k pixel units when using a computation apparatus capable of simultaneous computation in k pixel units.

21. A recording medium in accordance with claim 12, 15 or 18, wherein said pixel value detection is carried out in k pixel units when using a computation apparatus capable of simultaneous computation in k pixel units.

22. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and

output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said method comprising:

first, an addition step for adding said X0 to said X1 to generate new X1,

second, a doubling step for doubling said X0 to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

23. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, an addition means for adding said X0 to said X1 to generate new X1,

second, a doubling means for doubling said X0 to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

24. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 is doubled to generate new X0,

third, said new X1 is subtracted from said new X0, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

25. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform

computation,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a doubling step for doubling said X1 to generate new X1, and

third, an addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

26. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a doubling means for doubling said X1 to generate new X1, and

third, an addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

27. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 is doubled to generate new X1,

third, said new X0 is added to said new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

28. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said method comprising:

first, a first addition step for adding said X0 to said X1 to generate new X1,

second, a second addition step for adding said X0 to said X0 to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

29. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, a first addition means for adding said X0 to said X1 to generate new X1,

second, a second addition means for adding said X0 to said X0 to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer

X0 is used as output value Y1.

30. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 is added to said X0 to generate new X0,

third, said new X1 is subtracted from said new X0 to generate newer X0, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

31. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a first addition step for adding said X1 to said X1 to generate new X0, and

third, a second addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

32. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a first addition means for adding said X1 to said X1 to generate new X0, and

third, a second addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

33. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 is added to said X1 to generate new X0,

third, said new X0 is added to said new X1 to generate new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

34. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said method comprising:

first, a first addition step for adding said X0 to said X1 to generate new X1,

second, a shifting step for shifting said X0 used as a binary number by one bit to the MSB side to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

35. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, a first addition means for adding said X0 to said X1 to generate new X1,

second, a shifting means for shifting said X0 used as a binary number by one bit to the MSB side to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

36. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 used as a binary number is shifted by one bit to the MSB side to generate new X0,

third, said new X1 is subtracted from said new X0 to generate newer X0, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

37. A coding method for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform

computation,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a shifting step for shifting said X1 used as a binary number by one bit to the MSB side to generate new X1, and

third, a second addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

38. A coding apparatus for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a shifting means for shifting said X1 used as a binary number by one bit to the MSB side to generate new X1, and

third, a second addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

39. A recording medium including recorded coding programs to be executed by a computer for coding input image data in a predetermined signal format by dividing said image data into block units and by carrying out orthogonal transform in said block units,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least orthogonal transform computation, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 used as a binary number is shifted by one bit to the MSB side to generate new X1,

third, said new X0 is added to said new X1 to generate new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

40. A decoding method for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when the maximum code word length per code

word for said coded data is n (n: a natural number),

said variable-length decoding step comprising:

(1) a first table reference step for referring to a first table by using j-bit data of said code word as an input, for outputting code-length-related information and decoded data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information when code length s is j + 1 or more, and

(2) a second table reference step for computing a second table address from said second table access information and said s-bit data of said code word, for referring to said second table in accordance with said second table address, and for outputting decoded data.

41. A decoding apparatus comprising a variable-length decoding means for variable-length decoding coded data and a means for carrying out inverse orthogonal transform and signal format conversion by using the result of said decoding to obtain image data,

at the time when the maximum code word length per code word for said coded data is n (n: a natural number),

said variable-length decoding means comprising:

(1) a first table reference means for referring to a first table by using j-bit data of said code word as an input, for outputting code-length-related information and decoded

data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information when code length s is j + 1 or more, and

(2) a second table reference means for computing a second table address from said second table access information and said s-bit data of said code word, for referring to said second table in accordance with said second table address, and for outputting decoded data.

42. A recording medium including recorded coding programs to be executed by a computer for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when the maximum code word length per code word for said coded data is n (n: a natural number),

said variable-length decoding step comprising:

(1) a step for referring to a first table by using j-bit data of said code word as an input, for outputting code-length-related information and decoded data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information when code length s is j + 1 or more, and

(2) a step for computing a second table address from said second table access information and said s-bit data

of said code word, for referring to said second table in accordance with said second table address, and for outputting decoded data.

43. A decoding method for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a code word string obtaining step for obtaining j-bit data from the head of said code word string,

(2) a first table reference step for referring to a first table by using said obtained j-bit data as an input, for outputting code-length-related information and decoded data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information from said first table when code length s is j + 1 or more,

(3) a second table reference step for obtaining s-bit data from the head of said code word string, for computing a second table address from said second table access information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data, and

(4) a bit shifting step for obtaining code length s from said code-length-related information, for deleting the s-bit code from the head of said code word string, and for repeating this operation until the occurrence of an end code.

44. A decoding apparatus comprising a variable-length decoding means for variable-length decoding coded data and a means for carrying out inverse orthogonal transform and signal format conversion by using the result of said decoding to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding means comprising:

(1) a code word string obtaining means for obtaining j-bit data from the head of said code word string,

(2) a first table reference means for referring to a first table by using said obtained j-bit data as an input, for outputting code-length-related information and decoded data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information from said first table when code length s is j + 1 or more,

(3) a second table reference means for obtaining s-bit data from the head of said code word string, for computing a second table address from said second table access

information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data, and

(4) a bit shifting means for obtaining code length s from said code-length-related information, for deleting the s-bit code from the head of said code word string, and for repeating this operation until the occurrence of an end code.

45. A recording medium including recorded coding programs to be executed by a computer for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a step for obtaining j-bit data from the head of said code word string,

(2) a step for referring to a first table by using said obtained j-bit data as an input, for outputting code-length-related information and decoded data from said first table when code length s is j or less, and for outputting code-length-related information and second table access information from said first table when code length s is j + 1 or more,

(3) a step for obtaining s-bit data from the head of

said code word string, for computing a second table address from said second table access information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data, and

(4) a step for obtaining code length s from said code-length-related information, for deleting the s-bit code from the head of said code word string, and for repeating this operation until the occurrence of an end code.

46. A decoding method for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a code word string obtaining step for obtaining j-bit data from the head of said code word string,

(2) an expansion first table reference step, wherein a first table is made reference to by using said obtained j-bit data as an input, and when the sum of the code lengths of k or less continuous code words is j or less, code-length-related information for said k continuous code words and decoded data for each of said k or less continuous code words are output from said first table, and when code length

s is j + 1 or more, code-length-related information and second table access information are output from said first table, and

(3) a second table reference step for obtaining s-bit data from the head of said code word string, for computing a second table address from said second table access information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data.

47. A decoding apparatus comprising a variable-length decoding means for variable-length decoding coded data and a means for carrying out inverse orthogonal transform and signal format conversion by using the result of said decoding to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding means comprising:

(1) a code word string obtaining means for obtaining j-bit data from the head of said code word string, and an expansion first table reference means, wherein a first table is made reference to by using said obtained j-bit data as an input, and when the sum of the code lengths of k or less continuous code words is j or less, code-length-related information for said k continuous code words and decoded

data for each of said k or less continuous code words are output from said first table, and when code length s is j + 1 or more, code-length-related information and second table access information are output from said first table, and

(2) a second table referring means for obtaining s-bit data from the head of said code word string, for computing a second table address from said second table access information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data.

48. A recording medium including recorded coding programs to be executed by a computer for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a step for obtaining j-bit data from the head of said code word string,

(2) a step, wherein a first table is made reference to by using said obtained j-bit data as an input, and when the sum of the code lengths of k or less continuous code words is j or less, code-length-related information for said k

continuous code words and decoded data for each of said k or less continuous code words are output from said first table, and when code length s is j + 1 or more, code-length-related information and second table access information are output from said first table, and

(3) a step for obtaining s-bit data from the head of said code word string, for computing a second table address from said second table access information and said s-bit data, for referring to said second table in accordance with said second table address, and for outputting decoded data

49. A decoding method for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a code word string obtaining step for obtaining j-bit data from the head of said code word string,

(2) a first table reference step, wherein a first table is referred to by using said obtained j-bit data as an input, when the sum of the code lengths of m or less continuous code words is j or less, and when the sum of the code lengths of said m continuous code words and the code word next to said m continuous code words is determined uniquely,

information relating to the total code length of said m continuous code words and the code word next to said m continuous code words, decoded data for each of said m or less continuous code words, and second table access information regarding said code word next to said m continuous code words are output from said first table, and

(3) a second table reference step for gaining access to a second table by using said second table access information as an input and for outputting decoded data regarding said code word next to said m continuous code words.

50. A decoding apparatus comprising a variable-length decoding means for variable-length decoding coded data and a means for carrying out inverse orthogonal transform and signal format conversion by using the result of said decoding to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding means comprising:

(1) a code word string obtaining means for obtaining j-bit data from the head of said code word string,

(2) a first table reference means, wherein a first table is referred to by using said obtained j-bit data as an input, when the sum of the code lengths of m or less continuous

code words is j or less, and when the sum of the code lengths of said m continuous code words and the code word next to said m continuous code words is determined uniquely, information relating to the total code length of said m continuous code words and the code word next to said m continuous code words, decoded data for each of said m or less continuous code words, and second table access information regarding said code word next to said m continuous code words are output from said first table, and

(3) a second table reference means for gaining access to a second table by using said second table access information as an input and for outputting decoded data regarding said code word next to said m continuous code words.

51. A recording medium including recorded coding programs to be executed by a computer for subjecting coded data to variable-length decoding, inverse orthogonal transform and signal format conversion to obtain image data,

at the time when said coded data is a code word string subjected to variable-length coding, the maximum code word length per code word of which is n (n: a natural number),

said variable-length decoding step comprising:

(1) a step for obtaining j-bit data from the head of said code word string,

(2) a step, wherein a first table is referred to by using

said obtained j-bit data as an input, when the sum of the code lengths of m or less continuous code words is j or less, and when the sum of the code lengths of said m continuous code words and the code word next to said m continuous code words is determined uniquely, information relating to the total code length of said m continuous code words and the code word next to said m continuous code words, decoded data for each of said m or less continuous code words, and second table access information regarding said code word next to said m continuous code words are output from said first table, and

(3) a step for gaining access to a second table by using said second table access information as an input and for outputting decoded data regarding said code word next to said m continuous code words.

52. A decoding method in accordance with claim 40, 43, 46 or 49, wherein said j is a natural number satisfying $j < n$, and code-length-related information is determined uniquely by inputting at least j bits to said first table.

53. A decoding apparatus in accordance with claim 41, 44, 47 or 50, wherein said j is a natural number satisfying $j < n$, and code-length-related information is determined uniquely by inputting at least j bits to said first table.

54. A recording medium in accordance with claim 42, 45, 48 or 51, wherein said j is a natural number satisfying j

< n, and code-length-related information is determined uniquely by inputting at least j bits to said first table.

55. A decoding method in accordance with claim 40, 43, 46 or 49, wherein, with respect to a variable-length code to be subjected to said variable-length decoding, the code length to be assigned is shorter as data has higher occurrence probability.

56. A decoding apparatus in accordance with claim 41, 44, 47 or 50, wherein, with respect to a variable-length code to be subjected to said variable-length decoding, the code length to be assigned is shorter as data has higher occurrence probability.

57. A recording medium in accordance with claim 42, 45, 48 or 51, wherein, with respect to a variable-length code to be subjected to said variable-length decoding, the code length to be assigned is shorter as data has higher occurrence probability.

58. A decoding method in accordance with claim 40, 43 or 46, wherein, as said second table access information, the mask pattern and offset value of the code word corresponding thereto are output.

59. A decoding apparatus in accordance with claim 41, 44 or 47, wherein, as said second table access information, the mask pattern and offset value of the code word corresponding thereto are output.

60. A recording medium in accordance with claim 42, 45 or 48, wherein, as said second table access information, the mask pattern and offset value of the code word corresponding thereto are output.

61. A decoding method in accordance with claim 49, wherein, as said second table access information, a table access address offset value is output.

62. A decoding apparatus in accordance with claim 50, wherein, as said second table access information, a table access address offset value is output.

63. A recording medium in accordance with claim 51, wherein, as said second table access information, a table access address offset value is output.

64. A decoding method in accordance with claim 40 or 43, wherein said n = 16 and said j = 8.

65. A decoding apparatus in accordance with claim 41 or 44, wherein said n = 16 and said j = 8.

66. A recording medium in accordance with claim 42 or 45, wherein said n = 16 and said j = 8.

67. A decoding method in accordance with claim 46, wherein said n = 16, said j = 8 and said k = 2.

68. A decoding apparatus in accordance with claim 47, wherein said n = 16, said j = 8 and said k = 2.

69. A recording medium in accordance with claim 48, wherein said n = 16, said j = 8 and said k = 2.

70. A decoding method in accordance with claim 49, wherein said n = 16, said j = 8 and said m = 1.

71. A decoding apparatus in accordance with claim 50, wherein said n = 16, said j = 8 and said m = 1.

72. A recording medium in accordance with claim 51, wherein said n = 16, said j = 8 and said m = 1.

73. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said method comprising:

first, an addition step for adding said X0 to said X1 to generate new X1,

second, a doubling step for doubling said X0 to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

74. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said apparatus comprising:

first, an addition means for adding said X0 to said X1 to generate new X1,

second, a doubling means for doubling said X0 to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

75. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by inverse orthogonal transform computation and the like, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 is doubled to generate new X0,

third, said new X1 is subtracted from said new X0, and

said new X1 is used as output value Y0, and said newer

X0 is used as output value Y1.

76. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by inverse orthogonal transform computation and the like,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a doubling step for doubling said X1 to generate new X1, and

third, an addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

77. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by inverse orthogonal transform computation and the like,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a doubling means for doubling said X1 to generate new X1, and

third, an addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

78. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by inverse orthogonal transform computation and the like, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 to generate new X1,

third, said new X0 is added to said new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

79. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said method comprising:

first, a first addition step for adding said X0 to said X1 to generate new X1,

second, a second addition step for adding said X0 to said X0 to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

80. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said apparatus comprising:

first, a first addition means for adding said X0 to said X1 to generate new X1,

second, a second addition means for adding said X0 to said X0 to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

81. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 is added to said X0 to generate new X0,

third, said new X1 is subtracted from said new X0 to generate newer X0, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

82. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a first addition step for adding said X1 to said X1 to generate new X0, and

third, a second addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

83. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a first addition means for adding said X1 to said X1 to generate new X0, and

third, a second addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

84. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 is added to said X1 to generate new X0,

third, said new X0 is added to said new X1 to generate new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

85. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said method comprising:

first, a first addition step for adding said X0 to said X1 to generate new X1,

second, a shifting step for shifting said X0 used as a binary number by one bit to the MSB side to generate new X0, and

third, a subtraction step for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

86. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by inverse orthogonal transform computation and the like,

said apparatus comprising:

first, a first addition means for adding said X0 to said X1 to generate new X1,

second, a shifting means for shifting said X0 used as a binary number by one bit to the MSB side to generate new X0, and

third, a subtraction means for subtracting said new X1 from said new X0 to generate newer X0, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

87. A recording medium including recorded decoding

programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation, wherein

first, said X0 is added to said X1 to generate new X1,

second, said X0 used as a binary number is shifted by one bit to the MSB side to generate new X0,

third, said new X1 is subtracted from said new X0 to generate newer X0, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

88. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said method comprising:

first, a subtraction step for subtracting said X1 from said X0 to generate new X0,

second, a shifting step for shifting said X1 used as

a binary number by one bit to the MSB side to generate new X1, and

third, a second addition step for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

89. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation,

said apparatus comprising:

first, a subtraction means for subtracting said X1 from said X0 to generate new X0,

second, a shifting means for shifting said X1 used as a binary number by one bit to the MSB side to generate new X1, and

third, a second addition means for adding said new X0 to said new X1 to generate new X1, wherein

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

90. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded

data to inverse orthogonal transform and signal format conversion to obtain image data,

at the time when output value Y0, i.e., X0 + X1, and output value Y1, i.e., X0 - X1, are generated from two input values X0 and X1 by at least inverse orthogonal transform computation, wherein

first, said X1 is subtracted from said X0 to generate new X0,

second, said X1 used as a binary number is shifted by one bit to the MSB side to generate new X1,

third, said new X0 is added to said new X1 to generate new X1, and

said new X1 is used as output value Y0, and said newer X0 is used as output value Y1.

91. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data, comprising:

an existence range detection step, wherein, when said coded information is decoded to orthogonal coefficient components, only the non-zero orthogonal coefficient components are detected, and by storing the positions of said orthogonal coefficient components inside blocks, the existence range of orthogonal coefficient components is detected in block units, and

an inverse orthogonal transforming step wherein, when

the coefficient components other than DC components are all set to 0 by said existence range detection step, the pixel values of said blocks are replaced with said DC components or multiples of said DC components, and when coefficient components other than said DC components are present, ordinary inverse orthogonal transform is carried out.

92. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data, comprising:

an existence range detection means, wherein, when said coded information is decoded to orthogonal coefficient components, only the non-zero orthogonal coefficient components are detected, and by storing the positions of said orthogonal coefficient components inside blocks, the existence range of orthogonal coefficient components is detected in block units, and

an inverse orthogonal transforming means wherein, when the coefficient components other than DC components are all set to 0 by said existence range detection means, the pixel values of said blocks are replaced with said DC components or multiples of said DC components, and when coefficient components other than said DC components are present, ordinary inverse orthogonal transform is carried out.

93. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded

data to inverse orthogonal transform and signal format conversion in block units to obtain image data, wherein

when said coded information is decoded to orthogonal coefficient components, only the non-zero orthogonal coefficient components are detected, and by storing the positions of said orthogonal coefficient components inside blocks, the existence range of orthogonal coefficient components is detected in block units, and

when the coefficient components other than DC components are all set to 0 by said existence range detection step, the pixel values of said blocks are replaced with said DC components or multiples of said DC components, and when coefficient components other than said DC components are present, ordinary inverse orthogonal transform is carried out by said computer.

94. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into horizontal and vertical two-dimensional block units and transformed into orthogonal coefficient components by using orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using inverse orthogonal transform and the like,

assuming that either the horizontal or the vertical

direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction,

said method comprising:

an existence range detection step for detecting the existence range of non-zero orthogonal coefficient components in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components, and

an inverse orthogonal transform selection step, wherein plural kinds of inverse orthogonal transform steps for transforming orthogonal coefficient components into pixel components are provided, and said inverse orthogonal transform steps are selected depending on said range detected by said existence range detection step.

95. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into horizontal and vertical two-dimensional block units and transformed into orthogonal coefficient components by using orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using

at least inverse orthogonal transform; assuming that either the horizontal or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction,

said apparatus comprising:

an existence range detection means for detecting the existence range of non-zero orthogonal coefficient components in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components, and

an inverse orthogonal transform selection means, wherein plural kinds of inverse orthogonal transform means for transforming orthogonal coefficient components into pixel components are provided, and said inverse orthogonal transform means are selected depending on said range detected by said existence range detection means.

96. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into horizontal and vertical two-dimensional block units and

transformed into orthogonal coefficient components by using orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using inverse orthogonal transform and the like; assuming that either the horizontal or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction, wherein

the existence range of non-zero orthogonal coefficient components is detected in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components, and

plural kinds of inverse orthogonal transform for transforming orthogonal coefficient components into pixel components are provided, and selection of said inverse orthogonal transform is carried out by said computer depending on said detected existence range.

97. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into horizontal and vertical two-dimensional block units and transformed into orthogonal coefficient components by using

orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using inverse orthogonal transform or the like; assuming that either the horizontal or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction,

provided with a single or plural kinds of inverse orthogonal transform steps in said first direction and said second direction for transforming orthogonal coefficient components into pixel components,

said method comprising:

a first-direction existence range detection step for detecting the existence range of non-zero orthogonal coefficient components in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components,

a first-direction inverse orthogonal transform selection step for selecting said first-direction inverse orthogonal transform steps depending on said range detected by said first-direction existence range detection step,

a second-direction existence range detection step for detecting the existence range of non-zero orthogonal

coefficient components in said second direction for n coefficient component units after said first-direction inverse orthogonal transform, and

a second-direction inverse orthogonal transform selection step for selecting said second-direction inverse orthogonal transform steps depending on said range detected by said second-direction existence range detection step.

98. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into horizontal and vertical two-dimensional block units and transformed into orthogonal coefficient components by using orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using inverse orthogonal transform or the like; assuming that either the horizontal or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction,

provided with a single or plural kinds of inverse orthogonal transform means in said first direction and said second direction for transforming orthogonal coefficient

components into pixel components,

said apparatus comprising:

a first-direction existence range detection means for detecting the existence range of non-zero orthogonal coefficient components in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components,

a first-direction inverse orthogonal transform selection means for selecting said first-direction inverse orthogonal transform means depending on said range detected by said first-direction existence range detection means,

a second-direction existence range detection means for detecting the existence range of non-zero orthogonal coefficient components in said second direction for n coefficient component units after said first-direction inverse orthogonal transform, and

a second-direction inverse orthogonal transform selection means for selecting said second-direction inverse orthogonal transform means depending on said range detected by said second-direction existence range detection means.

99. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion in block units to obtain image data,

at the time when input pixels are divided into

horizontal and vertical two-dimensional block units and transformed into orthogonal coefficient components by using orthogonal transform, and information obtained by coding said orthogonal coefficient components is decoded by using inverse orthogonal transform or the like; assuming that either the horizontal or the vertical direction is referred to as a first direction and the other is referred to as a second direction, and that said two-dimensional block has m × n coefficient components comprising m coefficient components in said first direction and n coefficient components in said second direction,

provided with a single or plural kinds of inverse orthogonal transform in said first direction and said second direction for transforming orthogonal coefficient components into pixel components, wherein

the existence range of non-zero orthogonal coefficient components is detected in said first direction for said m coefficient component units when said coded information is decoded to orthogonal coefficient components,

selection of said first-direction inverse orthogonal transform is carried out depending on said existence range,

the existence range of non-zero orthogonal coefficient components in said second direction for n coefficient component units after said first-direction inverse orthogonal transform, and

selection of said second-direction inverse orthogonal transform is carried out depending on said existence range.

100. A decoding method in accordance with claim 91, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored is set to the position of the last non-zero orthogonal coefficient component.

101. A decoding apparatus in accordance with claim 92, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored is set to the position of the last non-zero orthogonal coefficient component.

102. A recording medium in accordance with claim 93, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored is set to the position of the last non-zero orthogonal coefficient component.

103. A decoding method in accordance with claim 94 or 97, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored in each orthogonal transform

unit in said first direction is set to the position of the last non-zero orthogonal coefficient component.

104. A decoding apparatus in accordance with claim 95 or 98, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored in each orthogonal transform unit in said first direction is set to the position of the last non-zero orthogonal coefficient component.

105. A recording medium in accordance with claim 96 or 99, wherein, when said existence range detection is carried out, in the case when orthogonal coefficient components are rearranged by using zigzag scanning during coding, an existence range to be stored in each orthogonal transform unit in said first direction is set to the position of the last non-zero orthogonal coefficient component.

106. A decoding method in accordance with claim 91, 94 or 97, wherein, in the case when simultaneous computation can be carried out in k orthogonal coefficient component units, said existence range detection is carried out in k orthogonal coefficient units.

107. A decoding apparatus in accordance with claim 92, 95 or 98, wherein, in the case when simultaneous computation can be carried out in k orthogonal coefficient component units, said existence range detection is carried out in k

orthogonal coefficient units.

108. A recording medium in accordance with claim 93, 96 or 99, wherein, in the case when simultaneous computation can be carried out in k orthogonal coefficient component units, said existence range detection is carried out in k orthogonal coefficient units.

109. A decoding method for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data, comprising:

a decoding step for decoding coded data in a predetermined signal format,

an inverse orthogonal transform step for subjecting said decoded data to inverse orthogonal transform, and

a signal format conversion step for converting said image data in said predetermined signal format subjected to said inverse orthogonal transform into image data in another signal format, wherein

said decoding step, said inverse orthogonal transform step and said signal format conversion step are carried out continuously for data in a predetermined range.

110. A decoding apparatus for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data, comprising:

a decoding means for decoding coded data in a predetermined signal format,

an inverse orthogonal transform means for subjecting said decoded data to inverse orthogonal transform, and

a signal format conversion means for converting said image data in said predetermined signal format subjected to said inverse orthogonal transform into image data in another signal format, wherein

said decoding means, said inverse orthogonal transform means and said signal format conversion means are carried out continuously for data in a predetermined range.

111. A recording medium including recorded decoding programs to be executed by a computer for subjecting coded data to inverse orthogonal transform and signal format conversion to obtain image data, wherein

coded data in a predetermined signal format is decoded,

said decoded data is subjected to inverse orthogonal transform,

said image data in said predetermined signal format subjected to said inverse orthogonal transform is converted into image data in another signal format, and

said decoding, said inverse orthogonal transform and said signal format conversion are carried out continuously for data in a predetermined range.

112. A decoding method in accordance with claim 109, wherein said image data in said predetermined signal format comprises luminance, first color difference and second

color difference signals, and image data after signal format conversion comprises red, green and blue signals.

113. A decoding apparatus in accordance with claim 110, wherein said image data in said predetermined signal format comprises luminance, first color difference and second color difference signals, and image data after signal format conversion comprises red, green and blue signals.

114. A recording medium in accordance with claim 111, wherein said image data in said predetermined signal format comprises luminance, first color difference and second color difference signals, and image data after signal format conversion comprises red, green and blue signals.

115. A decoding method in accordance with claim 109, wherein said image data in said predetermined signal format comprises luminance, first color difference and second color difference signals, and image data after signal format conversion comprises luminance, first color difference and second color difference signals having a configuration different from that before conversion.

116. A decoding apparatus in accordance with claim 110, wherein said image data in said predetermined signal format comprises luminance, first color difference and second color difference signals, and image data after signal format conversion comprises luminance, first color difference and second color difference signals having a configuration

different from that before conversion.

117. A recording medium in accordance with claim 111, wherein said image data in said predetermined signal format comprises luminance, first color difference and second color difference signals, and image data after signal format conversion comprises luminance, first color difference and second color difference signals having a configuration different from that before conversion.